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(54) **INK CONTAINER WITH SECONDARY CONTAINMENT FOR INK SUPPLY**

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Related U.S. Application Data

(63) Continuation of application No. 09/437,769, filed on Nov. 9, 1999, which is a continuation of application No. 08/868,927, filed on Jun. 4, 1997, now Pat. No. 6,010,210.

(51) **Int. Cl.**[7] **B21J 2/175**
(52) **U.S. Cl.** **347/86**; 347/85
(58) **Field of Search** 347/85, 86, 87

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,040,002	*	8/1991	Pollacek et al.	347/87
5,426,459		6/1995	Kaplinsky	347/87
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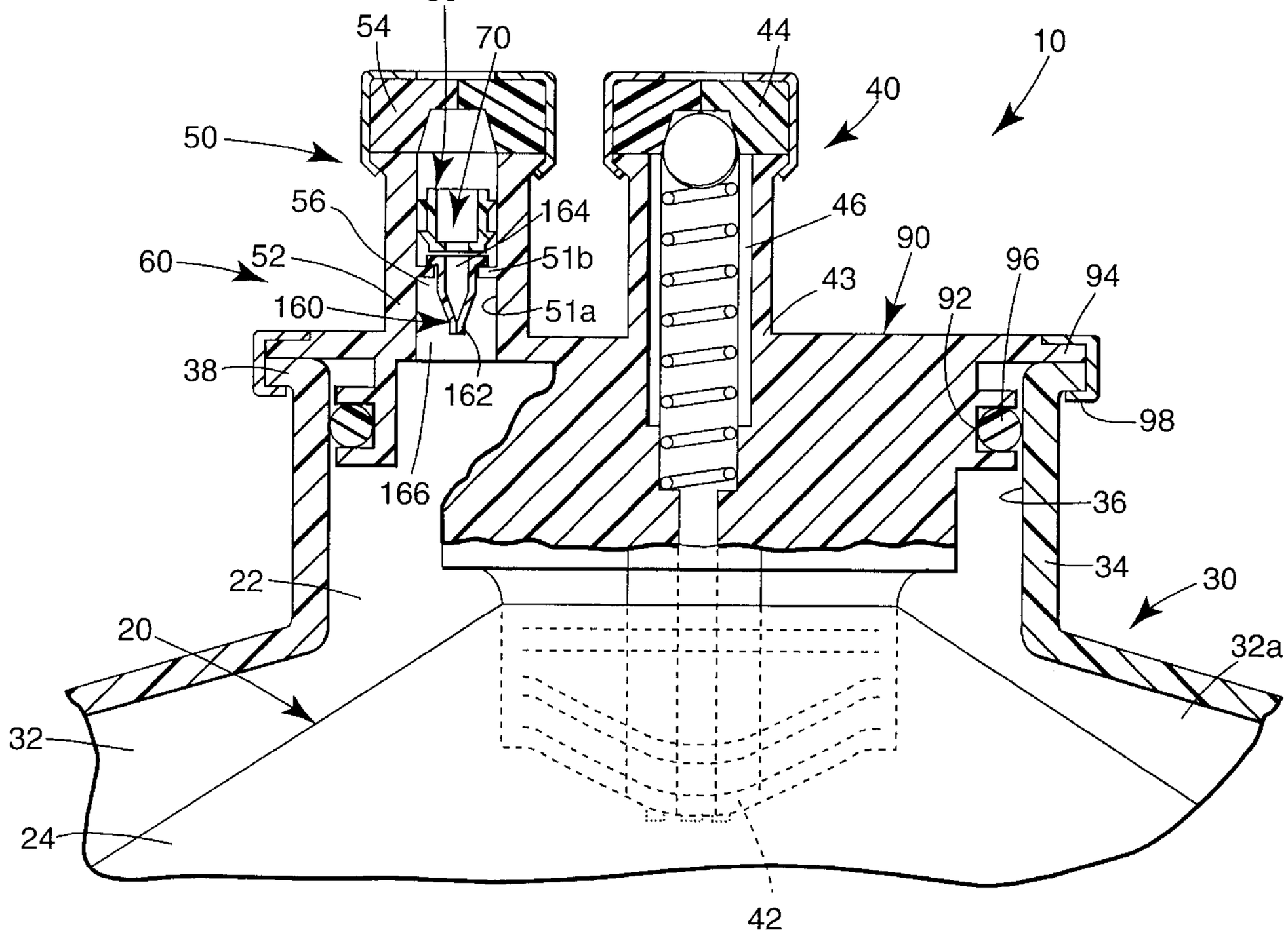
(57) **ABSTRACT**

An ink container for a supply of liquid ink includes a pressure vessel defining an interior chamber and a collapsible ink reservoir disposed within the interior chamber. The collapsible ink reservoir is adapted to hold the supply of liquid ink therein such that an ink passage communicates with the collapsible ink reservoir and externally of the pressure vessel, and an air passage communicates with the interior chamber of the pressure vessel and externally of the pressure vessel. A flow restrictor communicates with the air passage and, therefore, the interior chamber to restrict flow through the air passage from the interior chamber and permit flow through the air passage into the interior chamber.

32 Claims, 6 Drawing Sheets



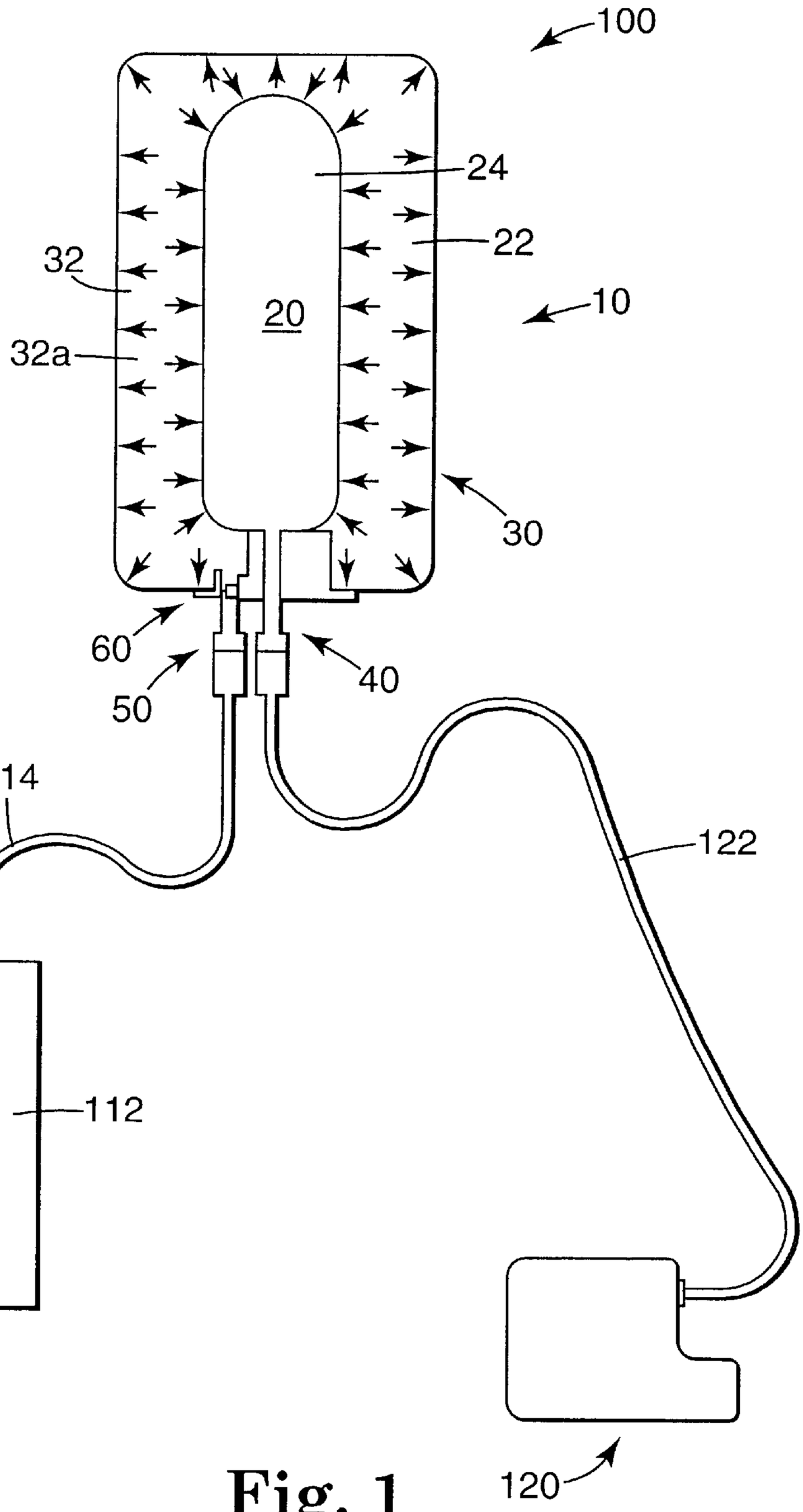


Fig. 1

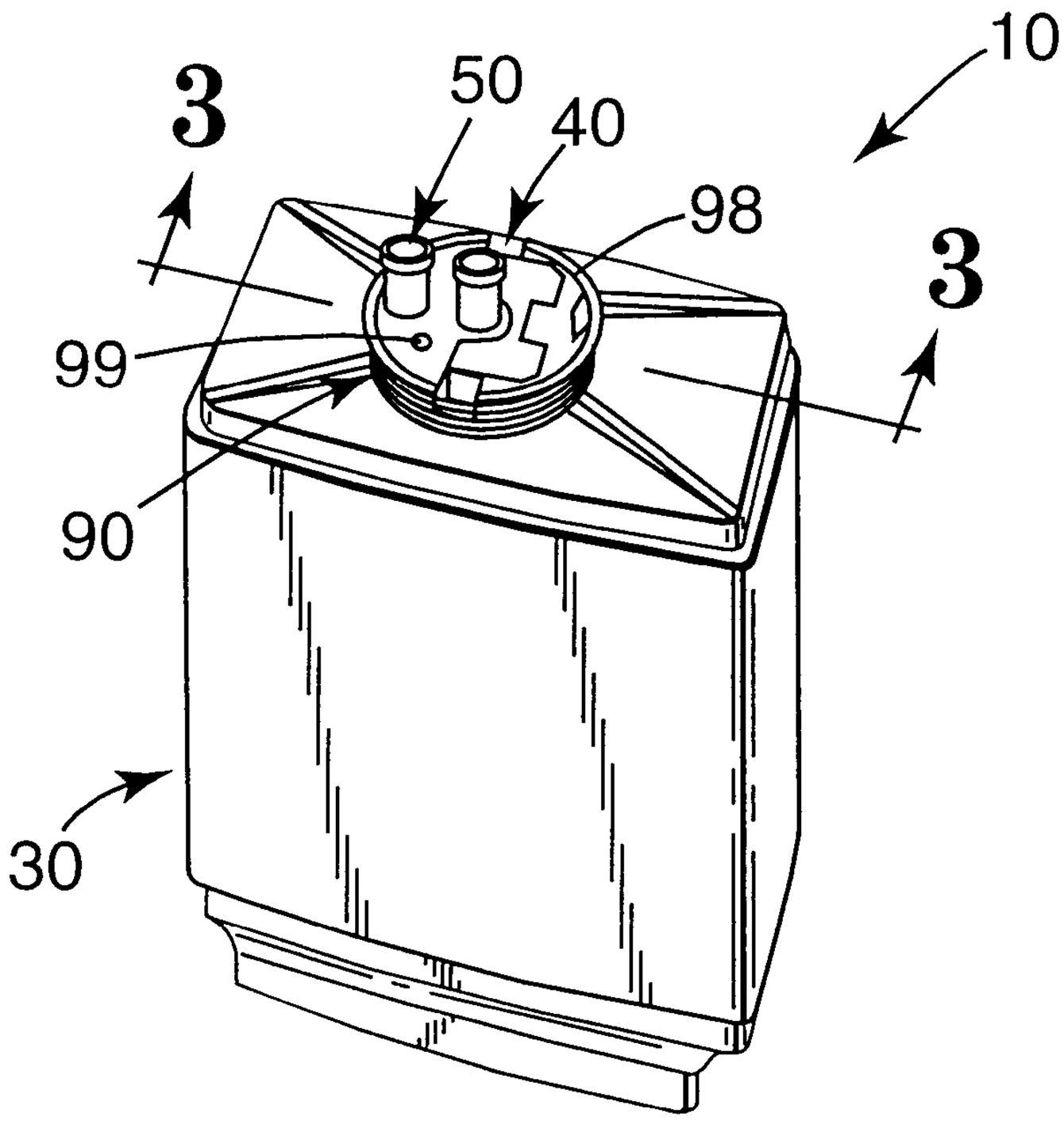


Fig. 2

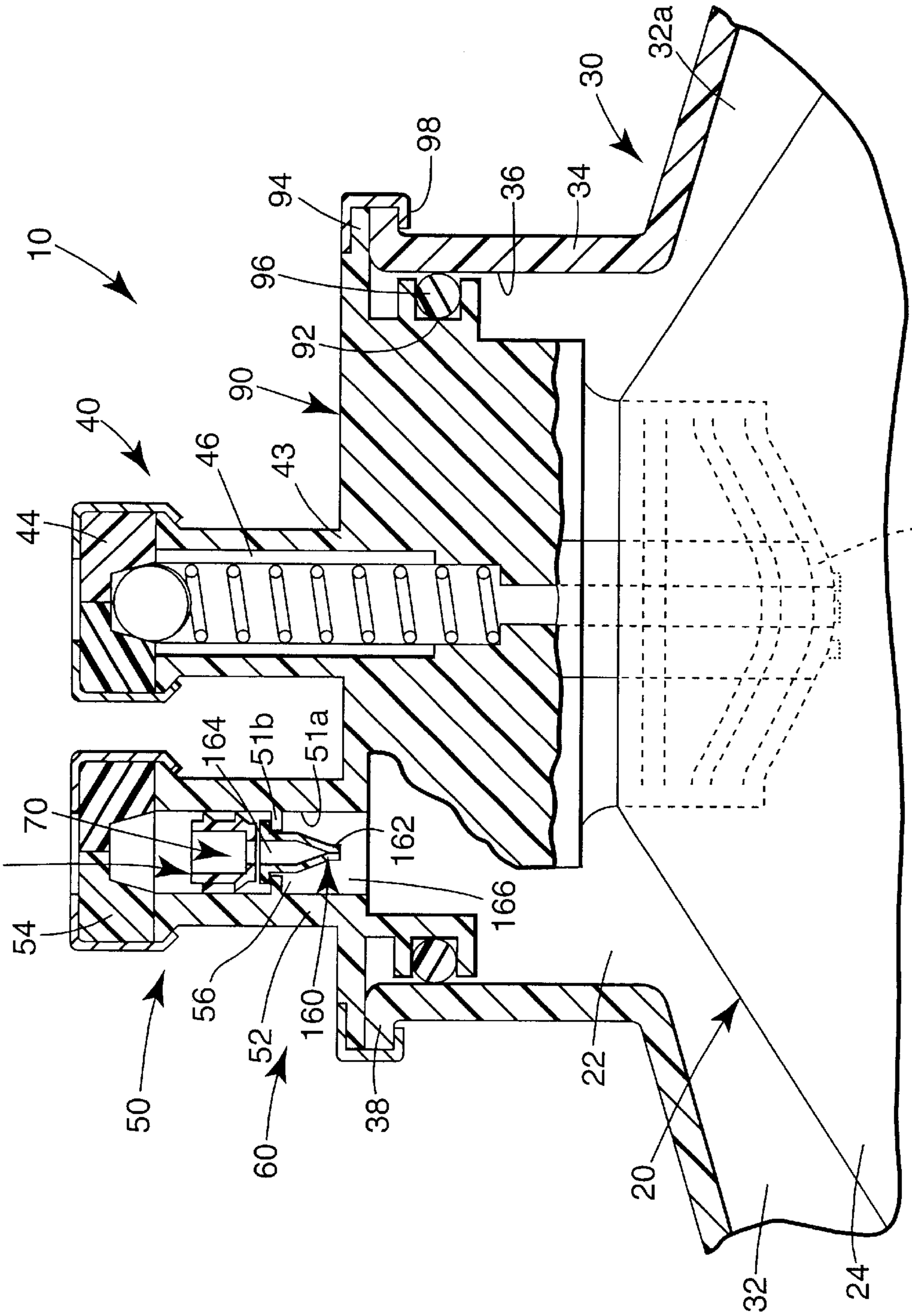

32a
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Fig. 3

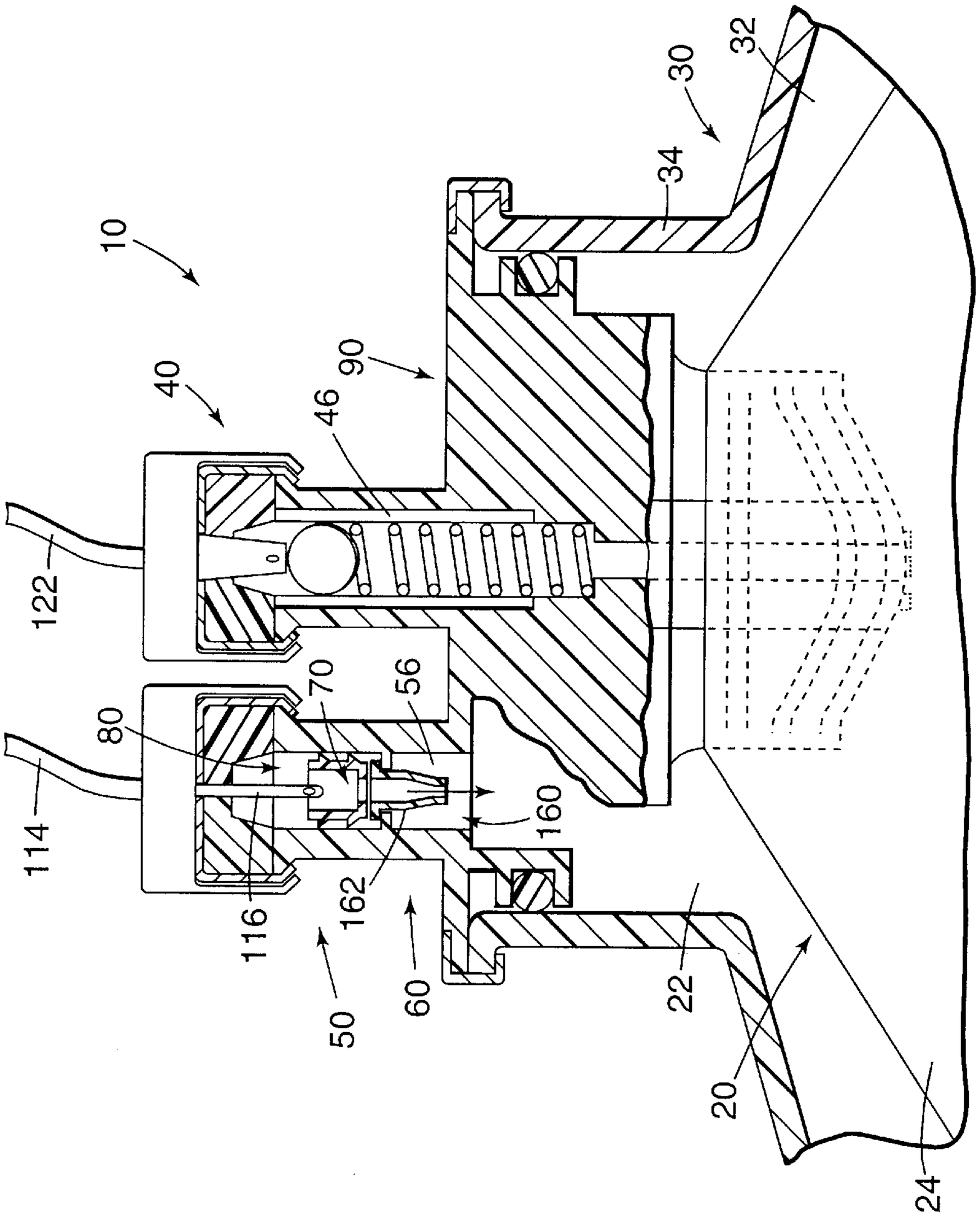

Fig. 4

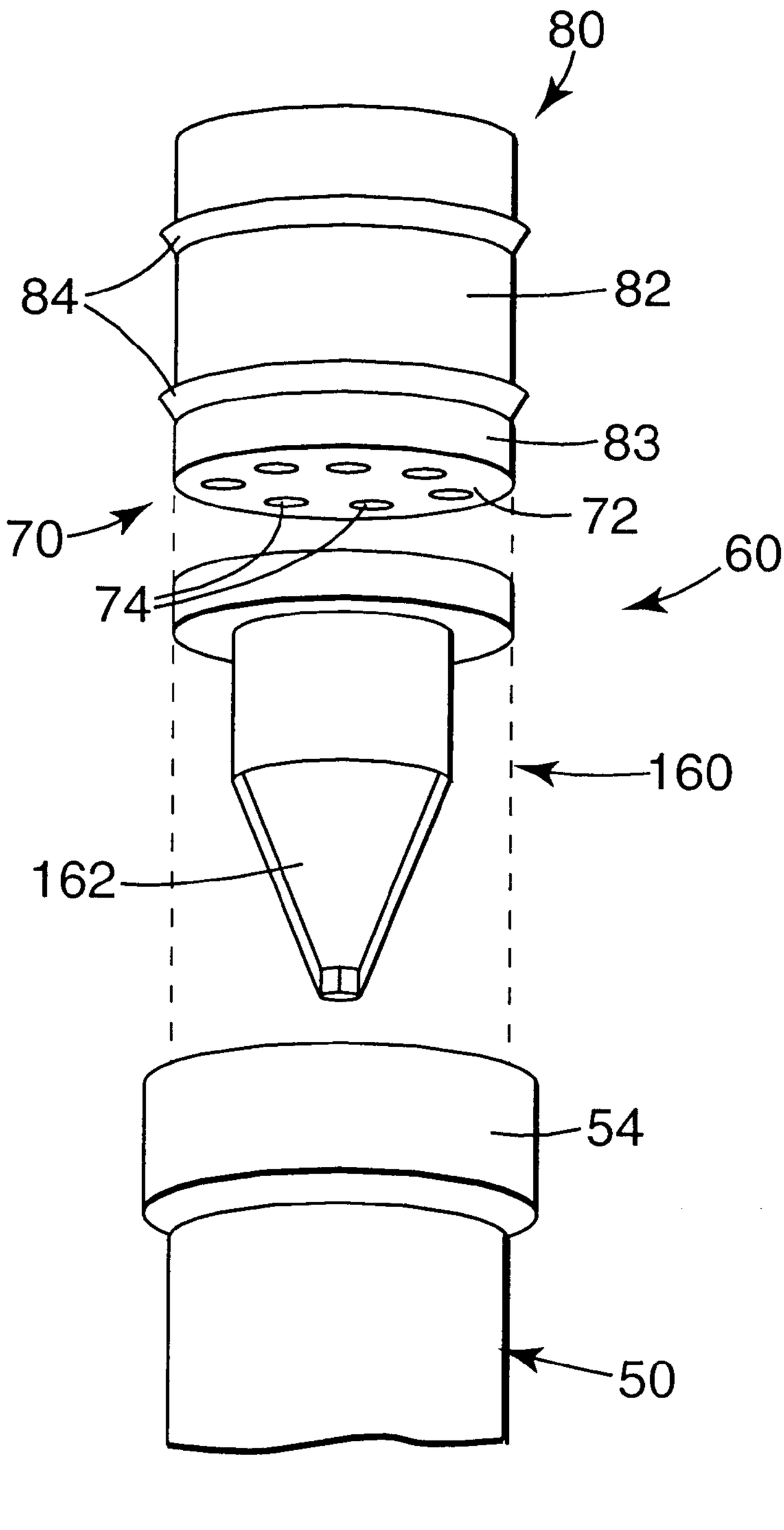

Fig. 5

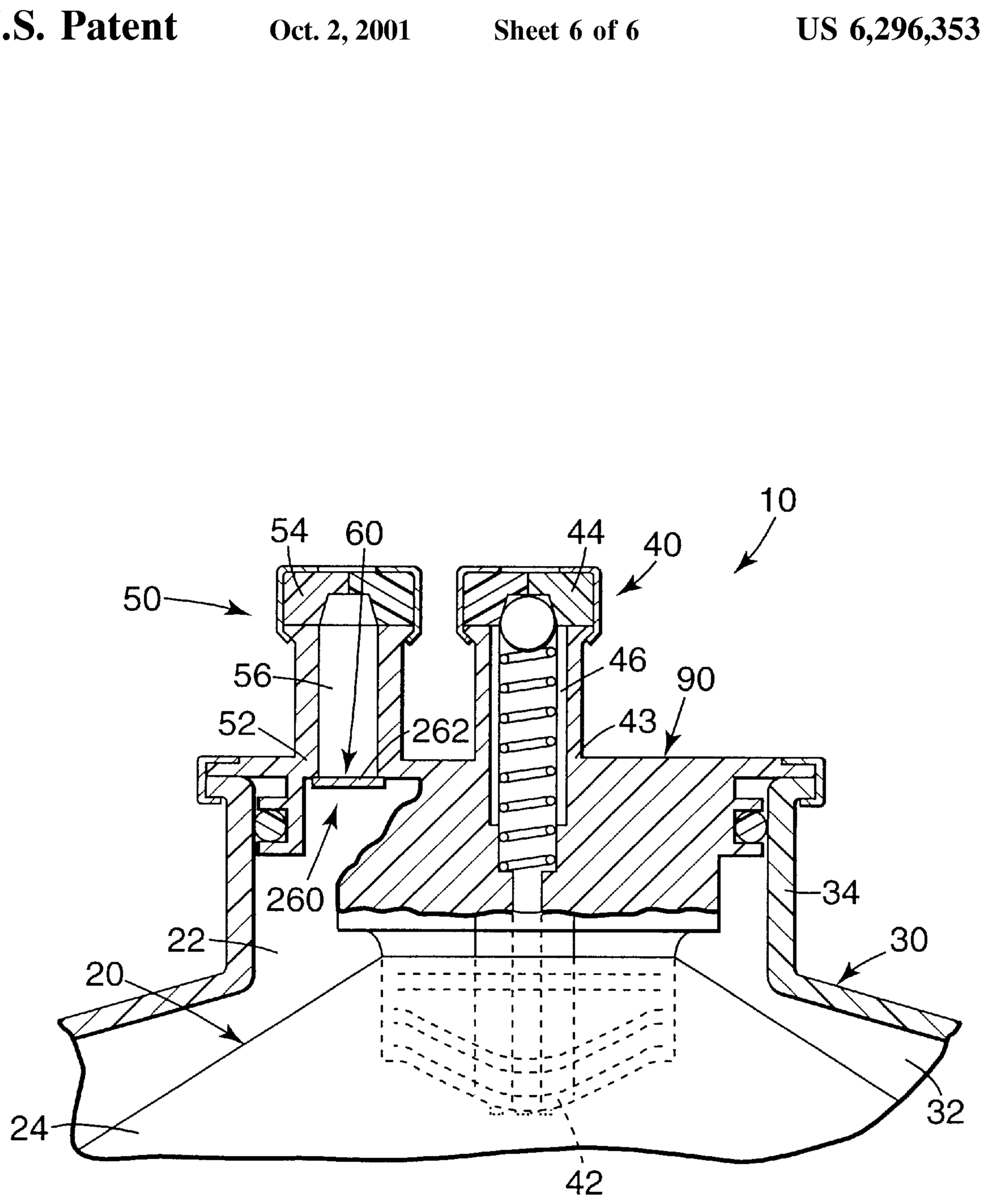

Fig. 6

INK CONTAINER WITH SECONDARY CONTAINMENT FOR INK SUPPLY

RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 09/437,769 titled INK CONTAINER HAVING A MULTIPLE FUNCTION CHASSIS filed Nov. 9, 1999; which is a continuation of U.S. patent application Ser. No. 08/868,927 titled INK CONTAINER HAVING A MULTIPLE FUNCTION CHASSIS filed Jun. 4, 1997, now issued U.S. Pat. No. 6,010,210.

THE FIELD OF THE INVENTION

The present invention relates generally to inkjet printing systems, and ore particularly to an ink container including secondary containment for a supply of liquid ink for an inkjet printing system.

BACKGROUND OF THE INVENTION

A conventional inkjet printing system includes a printhead and an ink supply which supplies liquid ink to the printhead. The printhead ejects ink drops through a plurality of orifices or nozzles and toward a print medium, such as a sheet of paper, so as to print a dot of ink on the print medium. Typically, the orifices are arranged in one or more arrays such that properly sequenced ejection of ink from the orifices causes characters or other images to be printed upon the print medium as the printhead and the print medium are moved relative to each other. In one arrangement, commonly referred to as "on-axis" printing, the ink supply is an integral element with the printhead. In another arrangement, however, commonly referred to as "off-axis" printing, the ink supply is a separate, self-contained ink container connected with the printhead by, for example, a flexible tube. With an off-axis printing system, the mass of the printhead is sharply reduced such that the cost of a printhead drive system and an overall size of a printer can be minimized, and a speed of printing can be increased. In addition, separating the ink supply from the printhead allows the ink to be replaced as it is consumed without requiring replacement of the costly printhead.

A conventional self-contained ink container for an off-axis printing system typically includes a pressure vessel and a collapsible ink reservoir, in the form of a bladder or bag, disposed within the pressure vessel for holding a supply of liquid ink therein. As such, a pressurized air system releases pressurized air into the pressure vessel and around the ink reservoir to collapse the ink reservoir and deliver ink to the printhead. The potential exists, however, for the collapsible ink reservoir to develop a leak. The leak could result, for example, from a pin hole in the collapsible ink reservoir, a rupture of the collapsible ink reservoir, and/or a defective seal of the collapsible ink reservoir. Unfortunately, if a leak does develop, ink can escape from the collapsible ink reservoir. If the ink container is installed with the printing system, ink escaping from the collapsible ink reservoir can enter and contaminate the pressurized air system. If the ink container is separate from the printing system, ink escaping from the collapsible ink reservoir can spill from the pressure vessel.

Accordingly, a need exists for secondary containment of liquid ink disposed within a collapsible ink reservoir of a self-contained ink container. More specifically, a need exists for containing liquid ink which could leak from the collapsible ink reservoir within the ink container and for preventing the liquid ink from spilling outside of the ink container.

SUMMARY OF THE INVENTION

One aspect of the present invention provides an ink container for a supply of liquid ink. The ink container includes a pressure vessel defining an interior chamber and a collapsible reservoir disposed within the interior chamber, wherein the collapsible reservoir is adapted to hold the supply of liquid ink therein. A first flow path communicates with the interior chamber of the pressure vessel and externally of the pressure vessel, and a second flow path communicates with the collapsible reservoir and externally of the pressure vessel. A flow restrictor communicates with the first flow path so as to restrict flow through the first flow path from the interior chamber and permit flow through the first flow path into the interior chamber.

In one embodiment, the first flow path constitutes a gas passage and the second flow path constitutes an ink passage.

In one embodiment, the flow restrictor comprises a one-way valve. In **30** one embodiment, the one-way valve comprises a duckbill check valve.

In one embodiment, the flow restrictor comprises a hydrophobic material, wherein the hydrophobic material restricts ink flow through the first flow path from the interior chamber and permits gas flow through the first flow path into the interior chamber.

In one embodiment, a filter is provided in the first flow path between the flow restrictor and an end of the first flow path communicating externally of the pressure vessel. In one embodiment, a retainer is provided in the first flow path between the filter and the end of the first flow path communicating externally of the pressure vessel, wherein the retainer is configured to retain the filter within the first flow path. In one embodiment, the filter and the retainer are integrally formed.

In one embodiment, a retainer is provided in the first flow path between the flow restrictor and an end of the first flow path communicating externally of the pressure vessel, wherein the retainer is configured to retain the flow restrictor within the first flow path. In one embodiment, the retainer includes an end having a plurality of holes therethrough.

Another aspect of the present invention provides an ink container for a supply of liquid ink. The ink container includes a pressure vessel defining an interior chamber and a collapsible reservoir disposed within the interior chamber, wherein the collapsible reservoir is adapted to hold the supply of liquid ink therein. The ink container also includes an air tower structure external to the pressure vessel and an ink tower structure external to the pressure vessel. As such, an air passage passes through the air tower structure so as to communicate with the interior chamber of the pressure vessel and an ink passage passes through the ink tower structure so as to communicate with the collapsible reservoir. An ink flow restrictor communicates with the air passage so as to restrict ink flow through the air passage from the interior chamber and permit air flow through the air passage into the interior chamber.

Another aspect of the present invention provides an ink container for a supply of liquid ink. The ink container includes a pressure vessel, a collapsible reservoir disposed within an interior chamber of the pressure vessel, and a chassis sealing an opening of a neck portion of the pressure vessel, wherein the collapsible reservoir is adapted to hold the supply of liquid ink therein. The chassis includes an air tower structure external to the pressure vessel and an ink tower structure external to the pressure vessel. As such, an air passage passes through the air tower structure so as to

communicate with the interior chamber of the pressure vessel and an ink passage passes through the ink tower structure so as to communicate with the collapsible reservoir. An ink flow restrictor communicates with the air passage so as to restrict ink flow through the air passage from the interior chamber and permit air flow through the air passage into the interior chamber.

Another aspect of the present invention provides an ink container for a supply of liquid ink. The ink container includes a pressure vessel defining an interior chamber and a collapsible reservoir disposed within the interior chamber, wherein the collapsible reservoir is adapted to hold the supply of liquid ink therein. A first flow path communicates with the interior chamber of the pressure vessel and externally of the pressure vessel, and a second flow path communicates with the collapsible reservoir and externally of the pressure vessel. A flow restrictor is disposed within the first flow path so as to restrict flow through the first flow path from the interior chamber and permit flow through the first flow path into the interior chamber, and a filter is disposed within the first flow path between an inlet end of the first flow path and the flow restrictor to prevent debris from clogging the flow restrictor.

Another aspect of the present invention provides a printing system including an ink container defining an interior chamber, a collapsible reservoir disposed within the interior chamber and adapted to hold a supply of liquid ink therein, a pressurized source of gas adapted to occupy a portion of the interior chamber during printing, and a printhead adapted to eject drops of the liquid ink during printing. A first flow path communicates with the interior chamber and externally of the ink container, and a second flow path communicates with the collapsible reservoir and externally of the ink container such that the pressurized source of gas communicates with the first flow path and the printhead communicates with the second flow path. A flow restrictor communicates with the first flow path so as to restrict flow through the first flow path from the interior chamber and permit flow through the first flow path into the interior chamber.

Another aspect of the present invention provides a method of providing liquid ink to a printing system from an ink container including an interior chamber and a collapsible reservoir disposed within the interior chamber, herein the collapsible reservoir is adapted to hold a supply of the liquid ink therein. The method includes the steps of communicating a first flow path with the interior chamber and externally of the ink container, communicating a second flow path with the collapsible reservoir and externally of the ink container, and restricting flow through the first flow path from the interior chamber and permitting flow through the first flow path into the interior chamber.

The present invention provides an ink container which includes secondary containment for liquid ink disposed within a collapsible ink reservoir of the ink container. As such, liquid ink which could leak from the collapsible ink reservoir is contained within the ink container and prevented from spilling outside of the ink container.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic illustration of a portion of an inkjet printing system including an ink container according to the present invention;

FIG. **2** is a top perspective view of an ink container according to the present invention;

FIG. **3** is a cross-sectional view taken along line **3**—**3** of FIG. **2** illustrating portions of the ink container including one embodiment of an ink flow restrictor in a closed state;

FIG. **4** is a cross-sectional view similar to FIG. **3** illustrating the ink flow restrictor in an open state;

FIG. **5** is an exploded, bottom perspective view of a portion of the ink container of FIG. **2**; and

FIG. **6** is cross-sectional view similar to FIG. **3** illustrating portions of the ink container including another embodiment of an ink flow restrictor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. It is to be understood that other embodiments may be utilized and structural or logical changes may be made without departing from the scope of the present invention. The following detailed description, therefore, is not to be taken in a limiting sense, and the scope of the present invention is defined by the appended claims.

FIG. **1** illustrates one embodiment of a portion of an inkjet printing system **100** according to the present invention. Inkjet printing system **100** is an off-axis printing system and includes an ink container **10**, a pressurized source **110**, and a printhead **120**. Ink container **10** includes a collapsible ink reservoir and a pressure vessel **30** surrounding collapsible ink reservoir **20** such that a pressure chamber **22** is defined between pressure vessel **30** and collapsible ink reservoir **20**. As such, pressurized source **110** communicates with pressure chamber **22** and printhead **120** communicates with collapsible ink reservoir **20**. Thus, pressurized air released into pressure chamber **22** pressurizes collapsible ink reservoir **20** and delivers pressurized ink to printhead **120**.

Pressurized source **110** includes a pressurized source of gas. In one embodiment, the gas is air delivered by a pump **112**. As such, pump **112** generates and delivers pressurized air to pressure chamber **22** via a pressure supply line **114**. While the following description only refers to using pressurized air, it is understood that use of other gases, or combinations of gases, is within the scope of the present invention.

Printhead **120** has a plurality of ink orifices (not shown) formed therein in a manner well known to those skilled in the art. Example embodiments of printhead **120** include a thermal printhead, a piezoelectric printhead, or any other type of inkjet printhead known in the art. If printhead **120** is, for example, a thermal printhead, printhead **120** typically includes a substrate layer (not shown) having a plurality of resistors (not shown) which are operatively associated with the ink orifices. Upon energization of the resistors, in response to command signals delivered by a controller (not shown) to printhead **120**, drops of ink are ejected through the ink orifices toward a print medium (not shown). In one embodiment, printhead **120** receives ink from ink container **10** via an ink supply line **122**.

As illustrated in FIGS. **1** and **2**, ink container **10** includes collapsible ink reservoir **20**, pressure vessel **30**, an ink tower structure **40**, an air tower structure **50**, and an ink flow restrictor **60**. Pressure vessel **30** defines an interior chamber **32** in which collapsible ink reservoir **20** is disposed. Thus, an unoccupied portion **32**a of interior chamber **32** is formed between pressure vessel **30** and collapsible ink reservoir **20**. As such, unoccupied portion **32***a* defines pressure chamber **22** surrounding collapsible ink reservoir **20**. In one embodiment, collapsible ink reservoir **20** is formed by a flaccid bag **24**. When full of ink, flaccid bag **24** substantially

occupies interior chamber **32** of pressure vessel **30**. While pressure vessel **30** is illustrated as being generally rectangular in shape, it is within the scope of the present invention for pressure vessel **30** to be of any size, shape, and/or volume.

As illustrated in FIGS. **2** and **3**, ink tower structure **40** has a first end **42** and a second end **44** with an intermediate portion **43** therebetween. First end **42** extends into pressure vessel **30** and is sealed within collapsible ink reservoir **20** as described in U.S. Pat. No. 6,010,210, the disclosure of which is incorporated herein by reference. Intermediate portion **43** is coupled with pressure vessel **30** and second end **44** provides an ink supply connection configured for connection with ink supply line **122** (FIG. **1**). As such, an ink flow passage **46** extends through ink tower structure **40**. Thus, ink flow passage **46** communicates with collapsible ink reservoir **20** and communicates externally of pressure vessel **30** such that second end **44** constitutes an outlet end of ink tower structure **40**.

As illustrated in FIGS. **2** and **3**, air tower structure **50** has a first end **52** and a second end **54**. First end **52** is coupled with pressure vessel **30** and second end **54** provides an air supply connection configured for connection with pressure supply line **114** (FIG. **1**). As such, an air flow passage **56** extends through air tower structure **50**. Thus, air flow passage **56** communicates with unoccupied portion **32***a* of interior chamber **32** and communicates externally of pressure vessel **30** such that second end **54** constitutes an inlet end of air tower structure **50**.

In one embodiment, ink tower structure **40** and air tower structure **50** are each external to pressure vessel **30**. As illustrated in FIG. **4**, ink supply line **122** communicates with ink tower structure **40** and pressure supply line **114** communicates with air tower structure **50**. Thus, ink supply line **122** communicates with ink flow passage **46** and pressure supply line **114** communicates with air flow passage **56**. As such, pressurized air is introduced into interior chamber **32** through pressure supply line **114**, air flow passage **56**, and ink flow restrictor **60**. By introducing pressurized air into interior chamber **32**, and more specifically, unoccupied portion **32**a, pressure within interior chamber **32** increases. Due to the increased pressure, a quantity of liquid ink is forced through ink flow passage **46** during printing. As such, liquid ink flows through ink tower structure **40** and ink supply line **122** to printhead **120**.

As illustrated in FIGS. **3–6**, ink flow restrictor **60** communicates with air flow passage **56** to restrict ink flow through air flow passage **56** from interior chamber **32**. Ink flow restrictor **60**, however, permits air flow through air flow passage **56** into interior chamber **32**. Should ink leak from collapsible ink reservoir **20**, ink flow restrictor **60** prevents ink from entering pressure supply line **114** and, subsequently, pressurized source **110** when ink container **10** is installed with printing system **100**. Ink flow restrictor **60**, therefore, prevents ink from contaminating pressure supply line **114** and/or pressurized source **110**. In addition, ink flow restrictor **60** prevents ink from spilling from pressure vessel **30** when ink container **10** is not connected with printing system **100**. Thus, ink low restrictor **60** restricts flow through air flow passage **56** from interior chamber **32** and permits flow through air flow passage **56** into interior chamber **32**.

FIGS. **3–5** illustrate one embodiment of ink flow restrictor **60**. Ink flow restrictor **160** is a one-way valve **162** provided within air flow passage **56**. One-way valve **162** communicates externally of air tower structure **50** on an input side **164** and communicates with interior chamber **32** on an output side **166**. One-way valve **162** permits substantially no flow in an upstream direction from interior chamber **32** and permits flow only in a downstream direction into interior chamber **32**.

In one embodiment, one-way valve **162** is made of a flexible material, for example, rubber, and is commonly referred to as a duckbill check valve. The duckbill check valve includes converging lips which are "normally closed" at zero differential pressure. As such, the duckbill check valve allows free flow with positive differential pressure and prevents backflow with negative differential pressure. An example of one-way valve **162** is a VA3120 valve manufactured by Vemay Laboratories. In one embodiment, air tower structure **50** has an interior surface **51***a* and includes a circumferential flange **51***b* extending radially inward therefrom. As such, circumferential flange **51***b* constitutes a retaining lip for one-way valve **162**.

One-way valve **162** has a closed state, as illustrated in FIG. **3**, and an open state, as illustrated in FIG. **4**, depending on an operational state of ink jet printing system **100**. When ink container **10** is connected with pressurized source **110** and printhead **120**, pressure supply line **114** is connected with air tower structure **50** and ink supply line **122** is connected with ink tower structure **40**, as illustrated in FIG. **4**. When pressure supply line **114** is connected with air tower structure **50**, a needle **116**, provided at an end of pressure supply line **114**, is inserted into air flow passage **56**. As such, pressurized air is released into air flow passage **56** through needle **116** from pressure supply line **114**. When pressurized air is released into air flow passage **56**, one-way valve **162** opens, as illustrated in FIG. **4**, to release air into pressure chamber **22** and pressurize collapsible ink reservoir **20**. When pressure within pressure chamber **22** reaches the pressure of pressure supply line **114**, one-way valve **162** closes.

In one embodiment, as illustrated in FIGS. **3–5**, a filter **70** is provided in-line in air flow passage **56** between ink flow restrictor **60** and second end **54** of air tower structure **50**. In addition, a retainer **80** is provided in-line in air flow passage **56** between filter **70** and second end **54** of air tower structure **50**. Filter **70** is a disc **72** which has a plurality of holes **74** formed therein and retainer **80** is a cylindrical sleeve **82**. Cylindrical sleeve **82** has an outer peripheral surface **83** and includes a retaining edge **84** protruding from outer peripheral surface **83**. As such, retaining edge **84** engages interior surface **511***a* of air tower structure **50** when retainer **80** is disposed within air passage **56**. Thus, retainer **80** retains filter **70** and ink flow restrictor **60** within air flow passage **56** while filter **70** prevents debris from clogging ink flow restrictor **60**. In one embodiment, filter **70** and retainer **80** are integrally formed such that disc **72** is formed at one end of cylindrical sleeve **82**. It is, however, within the scope of the present invention for filter **70** and retainer **80** to be formed separately.

FIG. **6** illustrates another embodiment of ink flow restrictor **60**. In one embodiment, ink flow restrictor **260** is provided at first end **52** of air tower structure **50**. Ink flow restrictor **260**, therefore, communicates with interior chamber **32** on one side and air flow passage **56** on an opposite side. In addition, ink flow restrictor **260** is a hydrophobic material, namely a material which lacks an affinity for water. An example of such material is GORE-TEX®, manufactured by W. L. Gore and Associates. Thus, ink does not pass through ink flow restrictor **260** and enter air flow passage **56**. Air, however, freely passes through ink flow restrictor **260**.

In one embodiment, as illustrated in FIGS. **2** and **3**, pressure vessel **30** includes a neck portion **34** having an

opening **36** extending therethrough and ink container **10** includes a chassis **90** with which ink tower structure **40** and air tower structure **50** are formed and to which collapsible ink reservoir **20** is connected for communication with ink flow passage **46** as described in the aforementioned U.S. Pat. No. 6,010,210. As such, opening **36** communicates with interior chamber **32** and communicates externally of pressure vessel **30**. Chassis **90**, however, seals opening **36** of neck portion **34**.

In one embodiment, ink tower structure **40** and air tower structure **50** each extend external to pressure vessel **30** in a first direction substantially perpendicular to chassis **90**. Ink tower structure **40** and air tower structure **50**, therefore, each protrude beyond neck portion **34** of pressure vessel **30** when chassis **90** seals opening **36**. While ink tower structure **40** and air tower structure **50** are illustrated as being formed integrally with chassis **90**, it is within the scope of the present invention for ink tower structure **40** and/or air tower structure **50** to be formed separately from and then secured to chassis **90**.

In one embodiment, chassis **90** fits within neck portion **34** and is secured to pressure vessel **30** so as to seal opening **36**. As such, chassis **90** has a circumferential groove **92** defined in an outer periphery thereof and includes a circumferential flange **94** extending radially outward therefrom. In addition, neck portion **34** includes a circumferential flange **38** extending radially outward therefrom. Thus, circumferential flange **94** of chassis **90** mates with circumferential flange **38** of pressure vessel **30** when chassis **90** is inserted into opening **36** of neck portion **34**. An o-ring **96** is disposed within circumferential groove **92** of chassis **90** to provide a fluid-tight seal with neck portion **34** and a crimp ring **98** secures circumferential flange **94** of chassis **90** to circumferential flange **38** of pressure vessel **30**. Furthermore, a vent **99** is provided in chassis **90** to slowly vent pressurized air from pressure vessel **30** when ink container **10** is depressurized.

In use, ink container **10** is connected with pressurized source **110** and printhead **120** by connecting pressure supply line **114** with air tower structure **50** and ink supply line **122** with ink tower structure **40**, as illustrated in FIGS. **1** and **4**. As such, pressurized air is released into air flow passage **56** and pressure chamber **22** through pressure supply line **114** so as to pressurize and collapse collapsible ink reservoir **20**. Thus, ink is forced through ink flow passage **46** and ink supply line **122** to printhead **120**. Should ink leak from collapsible ink reservoir **20** when ink container **10** is installed with printing system **100**, ink flow restrictor **60** prevents ink from passing through air flow passage **56** and entering pressure supply line **114** and, subsequently, pressurized source **110**. Ink flow restrictor **60**, therefore, prevents ink from contaminating pressure supply line **114** and/or pressurized source **110**. Furthermore, when ink container **10** is not connected with printing system **100**, ink flow restrictor **60** prevents ink from spilling from pressure vessel **30** if a leak develops with collapsible ink reservoir **20**.

By providing secondary containment for liquid ink disposed within collapsible ink reservoir **20**, ink container **10** prevents ink which could leak from collapsible ink reservoir **20** from contaminating pressure supply line **114** and/or pressurized source **110** when ink container **10** is installed with printing system **100**. In addition, ink container **10** prevents ink which could leak from collapsible ink reservoir **20** from spilling from pressure vessel **30** when ink container **10** is not connected with printing system **100**.

Although specific embodiments have been illustrated and described herein for purposes of description of the preferred embodiment, it will be appreciated by those of ordinary skill in the art that a wide variety of alternate and/or equivalent implementations calculated to achieve the same purposes may be substituted for the specific embodiments shown and described without departing from the scope of the present invention. Those with skill in the chemical, mechanical, electromechanical, electrical, and computer arts will readily appreciate that the present invention may be implemented in a very wide variety of embodiments. This application is intended to cover any adaptations or variations of the preferred embodiments discussed herein. Therefore, it is manifestly intended that this invention be limited only by the claims and the equivalents thereof

What is claimed is:

1. An ink container for a supply of liquid ink, the ink container comprising:

a pressure vessel defining an interior chamber;

a collapsible reservoir disposed within the interior chamber of the pressure vessel, the collapsible reservoir adapted to hold the supply of liquid ink therein;

a first flow path communicating with the interior chamber of the pressure vessel and communicating externally of the pressure vessel;

a second flow path communicating with the collapsible reservoir and communicating externally of the pressure vessel; and

a flow restrictor communicating with the first flow path, wherein the flow restrictor restricts flow through the first flow path from the interior chamber and permits flow through the first flow path into the interior chamber.

2. The ink container of claim **1**, wherein the first flow path constitutes a gas passage and the second flow path constitutes an ink passage, and wherein the flow restrictor restricts ink flow through the first flow path from the interior chamber.

3. The ink container of claim **2**, wherein the flow restrictor comprises a one-way valve and permits gas flow through the first flow path into the interior chamber.

4. The ink container of claim **3**, wherein the one-way valve comprises a duckbill check valve.

5. The ink container of claim **1**, wherein the flow restrictor comprises a hydrophobic material, wherein the hydrophobic material restricts ink flow through the first flow path from the interior chamber and permits gas flow through the first flow path into the interior chamber.

6. The ink container of claim **1**, further comprising:

a filter provided in the first flow path between the flow restrictor and an end of the first flow path communicating externally of the pressure vessel.

7. The ink container of claim **6**, further comprising:

a retainer provided in the first flow path between the filter and the end of the first flow path communicating externally of the pressure vessel, the retainer configured to retain the filter within the first flow path.

8. The ink container of claim **7**, wherein the filter and the retainer are integrally formed.

9. The ink container of claim **1**, further comprising:

a retainer provided in the first flow path between the flow restrictor and an end of the first flow path communicating externally of the pressure vessel, the retainer configured to retain the flow restrictor within the first flow path.

10. The ink container of claim 9, wherein the retainer includes an end having

a plurality of holes therethrough.

11. An ink container for a supply of liquid ink, the ink container comprising:

a pressure vessel defining an interior chamber;

a collapsible reservoir disposed within the interior chamber of the pressure vessel, the collapsible reservoir adapted to hold the supply of liquid ink therein;

an air tower structure external to the pressure vessel;

an ink tower structure external to the pressure vessel;

an air passage passing through the air tower structure and communicating with the interior chamber of the pressure vessel;

an ink passage passing through the ink tower structure and communicating with the collapsible reservoir; and

an ink flow restrictor communicating with the air passage, wherein the ink flow restictor restricts ink flow through the air passage from the interior chamber and permits air flow through the air passage into the interior chamber.

12. The ink container of claim 11, wherein the ink flow restrictor comprises a one-way valve.

13. The ink container of claim 12, wherein the one-way valve comprises a duckbill check valve.

14. The ink container of claim 11, wherein the ink flow restrictor comprises a hydrophobic material.

15. The ink container of claim 11, further comprising:

a filter provided in the air passage between the ink flow restrictor and an end of the air tower structure external to the pressure vessel.

16. The ink container of claim 15, further comprising:

a retainer provided in the air passage between the filter and the end of the air tower structure external to the pressure vessel, the retainer configured to retain the filter within the air passage.

17. The ink container of claim 16, wherein the filter and the retainer are integrally formed.

18. The ink container of claim 11, further comprising:

a retainer provided in the air passage between the ink flow restrictor and an end of the air tower structure external to the pressure vessel, the retainer configured to retain the ink flow restrictor within the air passage.

19. The ink container of claim 18, wherein the retainer includes an end having a plurality of holes therethrough.

20. The ink container of claim 19, wherein the retainer includes at least one retaining edge protruding from an outer peripheral surface thereof, the retaining edge engaging an interior surface of the air tower structure.

21. An ink container for a supply of liquid ink, the ink container comprising:

a pressure vessel defining an interior chamber and including a neck portion having an opening defined therein;

a collapsible reservoir disposed within the interior chamber of the pressure vessel, the collapsible reservoir adapted to hold the supply of liquid ink therein; and

a chassis sealing the opening of the neck portion, the chassis including:

an air tower structure external to the pressure vessel,

an ink tower structure external to the pressure vessel,

an air passage passing through the air tower structure and communicating with the interior chamber of the pressure vessel,

an ink passage passing through the ink tower structure and communicating with the collapsible reservoir, and

an ink flow restrictor communicating with the air passage, wherein the ink flow restrictor restricts ink flow through the air passage from the interior chamber and permits air flow through the air passage into the interior chamber.

22. An ink container for a supply of liquid ink, the ink container comprising:

a pressure vessel defining an interior chamber;

a collapsible reservoir disposed within the interior chamber of the pressure vessel, the collapsible reservoir adapted to hold the supply of liquid ink therein;

a first flow path communicating with the interior chamber of the pressure vessel, the first flow path having an inlet end communicating externally of the pressure vessel;

a second flow path communicating with the collapsible reservoir, the second flow path having an outlet end communicating externally of the pressure vessel;

a flow restrictor disposed within the first flow path, wherein the flow restrictor restricts flow through the first flow path from the interior chamber and permits flow through the first flow path into the interior chamber; and

a filter disposed within the first flow path between the inlet end of the first flow path and the flow restrictor.

23. The ink container of claim 22, wherein the first flow path constitutes a gas passage and the second flow path constitutes an ink passage, and wherein the flow restrictor restricts ink flow through the first flow path from the interior chamber.

24. The ink container of claim 23, wherein the flow restrictor comprises a one-way valve and permits gas flow through the first flow path into the interior chamber.

25. The ink container of claim 24, wherein the one-way valve comprises a duckbill check valve.

26. The ink container of claim 22, wherein the filter comprises a circular disc having a plurality of holes therethrough.

27. The ink container of claim 22, further comprising:

a retainer provided in the first flow path between the inlet end of the first flow path and the filter.

28. The ink container of claim 27, wherein the retainer comprises a cylindrical sleeve.

29. A printing system, comprising:

an ink container defining an interior chamber;

a collapsible reservoir disposed within the interior chamber and adapted to hold a supply of liquid ink therein;

a first flow path communicating with the interior chamber and communicating externally of the ink container;

a second flow path communicating with the collapsible reservoir and communicating externally of the ink container;

a flow restrictor communicating with the first flow path, wherein the flow restrictor restricts flow through the first flow path from the interior chamber and permits flow through the first flow path into the interior chamber;

a pressurized source of gas communicating with the first flow path, the pressurized source of gas adapted to occupy a portion of the interior chamber during printing; and

a printhead communicating with the second flow path, the printhead adapted to eject drops of the liquid ink during printing.

30. The printing system of claim 29, wherein the flow restrictor restricts ink flow through the first flow path from

the interior chamber and permits gas flow through the first flow path into the interior chamber.

31. A method of providing liquid ink to a printing system from an ink container including an interior chamber and a collapsible reservoir disposed within the interior chamber, the collapsible reservoir adapted to hold a supply of the liquid ink therein, the method comprising the steps of:

communicating a first flow path with the interior chamber and communicating the first flow path externally of the ink container; communicating a second flow path with the collapsible reservoir and communicating the second flow path externally of the ink container; and

restricting flow through the first flow path from the interior chamber and permitting flow through the first flow path into the interior chamber.

32. The method of claim **31**, wherein the step of restricting flow through the first flow path from the interior chamber and permitting flow through the first flow path into the interior chamber includes restricting ink flow through the first flow path from the interior chamber and permitting gas flow through the first flow path into the interior chamber.

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